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Engineering**www.elsevier.com/locate/procedia**Advanced in Control Engineering and Information Science****Risk Evaluation of the Logistics Ecological Environment System Based on FAHP****Zhang Jianwei^{*a}, Zhu Minjie^b, Zhang Liwei^c**^a Architectural Engineering Institute of Dalian University, Dalian 116622, China^b Machinery Engineering Institute of Dalian University, Dalian 116622, China^c Dalian maritime university, Dalian, China**Abstract**

Based on discussion of the development course and the present situation of logistic industry, the concept of the logistics ecological environment will be put forward in the paper. As we know, all kinds of risk still exist in the every link of the logistics ecological environment system, any problem from any link will affect the security, accurate and timeliness of the whole logistics system. By the analysis of the sources of risk of the logistics ecological environment system, this paper will construct the evaluation index system of risk for the ecological environment of logistics, and divide the risk factors from the logistics system of the ecological environment into quantitative factors and fuzzy factors, according to this mentality, and go on to analyze and evaluate risk system of the logistics ecological environment by the method of the FAHP, and carry on comprehensive evaluation.

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Keywords: Logistics Ecological Environment; Risk Identification; Index System; FAHP(Fuzzy Analytic Hierarchy Process)**1. Introduction**

The logistics industry in China started late, the market demand from logistics continues to expand with the rapid development of national economy. After entering the 21st century, the Chinese logistics industry logistics system continues improvement, the running of industry has become more mature and standardized day and day, under the influence of continuing to strengthen.

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Logistics ecology is a bionic concept, accurately, what this paper wants to study is also just the external environment of the micro level where the logistics related subject is in, included with the government,

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industry, and the social credit system, interests and risk aversion, regulations, standards and other aspects of content.

It should be noted, the above logistics ecological system has not formed an organic whole, this system has not been paid enough attention, logistics industry still exist the prominent problems of the less of financial support policy, financing difficulties and small scale, not standard and balanced development, necessary lag and so on, that is difficult to adapt to the needs of the development of the situation, against the ecosystem of the logistics health, organic, sustainable development.

From the analysis of form and overall, the logistics ecological system based on the present domestic economic environment is still in the initial stage of formation, the favorable development still need to face a series of questions from the mechanism restrictions, financing obstacles, external support policies, laws and regulations, market distortion and vicious competition, and so on, in order to promote the steady development of the logistics industry, it is a necessity to build a good logistics ecological environment. Therefore, this paper will take the construction of logistics ecological system as the goal, propose optimization logistics ecological mechanism, the purpose is to make the development from logistics ecological environment become the inner motivation to promote the progress of logistics industry.

This paper will construct the evaluation index system of risk for the ecological environment of logistics, and divide the risk factors from the logistics system of the ecological environment into quantitative factors and fuzzy factors, according to this mentality, and go on to analyze and evaluate risk system of the logistics ecological environment by the method of the FAHP, and carry on comprehensive evaluation.

2. Risk Analysis of Logistics Ecological Environment System

2.1. Risk Factors in the Logistics Ecological Subject

- ① the Operating Restrictions of Logistics Service Enterprise

Logistics enterprises as market service main body, although economic cooperation relationship with owner, but, under the management of contract chain, no matter what type of logistics service enterprise still undertakes a relative risk, can say that is the relative inequality in the market, and owners can avoid logistics risk. Because the relative logistics market is not standard, the different system of each logistics service enterprise, malignant competition, which must increase the risk of logistics enterprise.

- ② the Related Issues from the Government Departments

Currently in logistics services, they are all still supporting the development of industries from local governments to the central authorities, and have established association, however, under the supervision system, support and the support strength is not enough now.

- ③ the Service Problems from Logistics Intermediaries

Due to the backward and imperfect development of the industry, the professional development of the professional intermediary organization must be lags far behind, and the understanding ability to logistics project, its own risk management level and logistics market risk screened ability needs improving, the structural uncoordinated between variety logistics project and the individuality demand still exist, and lack of effective services products.

- ④ Financial Service Mechanism Not Fundamentally Established.

2.2. Risk Factors in the Logistics Ecological Environment

- ① Poor overcoatability and compatibility of logistics infrastructure
- ② Low professional technology level and weak system function

- ③ The lag standardized construction
- ④ Human resources quality cultivation mechanism lag
- ⑤ Laws and regulations construction lag

According to above analysis, establish the risk evaluation index system of logistics ecological environment, as shown in table 1:

Table 1: Risk Evaluation Index System of Logistics Ecological Environmental

Target layer	stair-index U	Index type	secondary- index b	Weight (%)
Risk Evaluation Index of Logistics Ecological Environmental	Risk Factors in the Logistics Ecological Subject U_1	Quantitative evaluation index	the Operating Restrictions of Logistics Service Enterprise b_1	20
			The service problems from logistics intermediaries b_2	5
		Fuzzy evaluation index	the related issues from the government departments b_3	15
			Financial Service Mechanism not Fundamentally Established. b_4	10
	Risk Factors in the Logistics Ecological Environment U_2	Quantitative evaluation index	Poor Overcoatability and Compatibility of Logistics Infrastructure b_5	15
			Low Professional Technology Level and Weak System Function b_6	15
			The Lag Standardized Construction b_7	10
		Fuzzy evaluation index	Human Resources Quality Cultivation Mechanism Lag b_8	5
			Laws and Regulations Construction Lag b_9	5

3. Mathematical model

Supposing we study a region of Logistics ecological environment, its Logistics ecological environment has much risk, the risk evaluation index system as shown in table 1. We use FAHP to study appraise system by quantitative evaluation index and Fuzzy evaluation index. Concrete steps are as follows:

- 1. Determine the fuzzy evaluation index

$$U=(U_1, U_2)$$

- 2. Determine the evaluation index

The evaluation index can use rating, we use five levels, namely security, less risk, commonly risk, higher risk, high risk, namely

$$V=(V_1, V_2, V_3, V_4, V_5) \quad V=(\text{security, less risk, risk in general, higher risk, high risk})$$

- 3. Determine the degree of membership index

The degree of membership index may choose 100 point system to evaluate, thereinto security 100, less risk 80, commonly risk 60, higher risk 30, high risk 10.

$$X=(X_1, X_2, X_3, X_4, X_5) \quad X=(100, 80, 60, 30, 10)$$

- 4. Determine Weight of Various index

$$\text{Fuzzy evaluation index weight set: } B_f=(b_3, b_4, b_8, b_9)$$

$$\text{Quantitative evaluation index weight set: } B_d=(b_1, b_2, b_5, b_6, b_7)$$

Can be drawn from Table 1, the following collections of two weights:

$$B_f=(0.15, 0.10, 0.05, 0.05)$$

$$B_d=(0.20, 0.05, 0.15, 0.15, 0.10)$$

- 5. Calculate the degree of membership Matrix

The various index to determine the degree of membership.

Through considering the fuzzy comprehensive evaluation, use expert evaluation method to do the fuzzy evaluation of the indicators, namely, the various indicators to determine the degree of membership. Set up fuzzy evaluation form, as shown in table 2:

Table 2: Logistics Ecological Environment Fuzzy Risk Evaluation Form

Evaluation Membership degree Evaluation index	V ₁ 100	V ₂ 80	V ₃ 60	V ₄ 30	V ₅ 10
b ₃	0.1	0.2	0.3	0.3	0.1
b ₄	0.1	0.2	0.4	0.2	0.1
b ₈	0.2	0.2	0.2	0.3	0.1
b ₉	0.2	0.2	0.3	0.2	0.1

- 6. Calculated comprehensive the degree of membership Matrix

Comprehensive the degree of membership Matrix $G=R \times U$

$$G = \begin{pmatrix} R_{11} & R_{12} & \dots \\ R_{21} & R_{22} & \dots \\ \vdots & \vdots & \dots \\ R_{n1} & R_{n2} & \dots \end{pmatrix}$$

$$R = \begin{pmatrix} 0.1 & 0.2 & 0.3 & 0.3 & 0.1 \\ 0.1 & 0.2 & 0.4 & 0.2 & 0.1 \\ 0.2 & 0.2 & 0.2 & 0.3 & 0.1 \\ 0.2 & 0.2 & 0.3 & 0.2 & 0.1 \end{pmatrix} * \begin{pmatrix} 100 \\ 80 \\ 60 \\ 30 \\ 10 \end{pmatrix} = \begin{pmatrix} 54 \\ 57 \\ 58 \\ 61 \end{pmatrix}$$

$$G^T = (54, 57, 58, 61)$$

- 7. Calculation the percentage of the quantitative evaluation

$$g = (g_1, g_2, \dots, g_5)$$

Positive volume index expressions A: $Y = 100 - (P - X) \times a$

Inverse indicators expressions B: $Y = 100 - (X - P) \times a$

Table3: Logistics Ecological Environment Risk Quantitative Risk Evaluation Form

QUANTITATIVE INDICATORS	ACTUAL VALUES	STANDARD VALUES	CALCULATION METHOD	SCORE
b ₁	10	20	FORMULA A, A=5	50
b ₂	98	100	FORMULA A, A=5	90
b ₅	2	0	FORMULA B, A=20	60
b ₆	80	100	FORMULA B, A=2	60
b ₇	10	20	FORMULA A, A=5	50

Percentage aggregate of the quantitative evaluation: $g = (50, 90, 60, 60, 50)$

- 8. comprehensive degree of membership $D=[G, g^T]$
- 9. evaluation total score $W=[b_f, b_d] \times [G, g^T]=58.87$

4. conclusion

In this paper, evaluate the risk of logistics ecological environment by fuzzy analytic hierarchy process. Risks are divided into two kinds (Quantitative evaluation index and Fuzzy evaluation index). Risk assessment of Logistics ecological environment and early warning control still need to be perfected in future studies.

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